GROUP THEORY.

7. Proposed by **M. E. GRABER, A. M.**, Heidelberg University, Tiffin, Ohio.

Which linear substitution will transform $x_1x_2+x_3x_4+x_5x_6=0$ into $y_1^2+y_2^2+y_3^2-y_4^2-y_5y_6=0$?

Remark by the PROPOSER.

One substitution having the desired property is

$$\left\{\begin{matrix} x_1, & x_2, & x_3, & x_4, & x_5, & x_6, \\ y_1+iy_2, & y_1-iy_2, & y_3+y_4, & y_3-y_4, & -y_5, & y_6, \end{matrix}\right\}^*$$

where $i=\sqrt{-1}$.

PROBLEMS FOR SOLUTION.

ALGEBRA.

237. Proposed by **F. P. MATZ, Sc. D., Ph. D.**, Reading, Pa.

Solve $x^2+y+z=12$.....(1) ; $x+y^2+z=8$.....(2) ; $x+y+z^2=6$.....(3).

238. Proposed by **S. A. COREY**, Hiteman, Iowa.

Prove that $\frac{1}{1+n}+\frac{1}{3(n+3)}+\frac{1}{5(n+5)}+\text{.........}=\frac{1}{2}\left[\frac{1}{(n-1)}+\frac{1}{3(n-3)}+\frac{1}{5(n-5)}+\text{.....}+\frac{1}{l(n-l)}\right]$, n being an even positive integer and $l=n-1$.

239. Proposed by **J. J. KEYES**, Fogg High School, Nashville, Tenn.

Solve $\sqrt[4]{(41+x)}+\sqrt[4]{(41-x)}=4$.

GEOMETRY.

260. Proposed by **W. J. GREENSTREET. M. A.**, Editor of The Mathematical Gazette, Stroud, England.

Perpendiculars to the radius vector are drawn through points on $r=a+b\cos n\theta$. Find the radius of curvature of their envelope at a point at a given distance from the origin.

261. Proposed by **R. D. CARMICHAEL**, Hartselle, Alabama.

Given three non-intersecting circles; to draw eight tangent circles, each tangent to all three of the given circles.

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*More generally, one set of substitutions fulfilling the required conditions, is

$$\left\{\begin{matrix} x_1, & x_2, & x_3, & x_4, & x_5, & x_6, \\ ay_1\pm aiy_2, & ay_1\mp aiy_2, & ay_3\pm ay_4, & ay_3\pm ay_4, & \pm ay_5, & \mp ay_6, \end{matrix}\right\}$$

where a is not equal 0. Ed. E.

262. Proposed by NELSON L. RORAY, Utica, New York.

In a regular pentagon, show that $\dfrac{\text{diagonal}}{\text{side}}=\dfrac{2\text{ apothem}}{\text{radius}}=\frac{1}{2}.\dfrac{5+\sqrt{5}}{\sqrt{5}}$.

CALCULUS.

199. Proposed by F. P. MATZ, Sc. D., Ph. D., Reading, Pa.

If the perimeter of an ellipse varies uniformly at the rate of $\frac{1}{4}$ inch per unit of time, at what rate is the eccentricity varying the instant the perimeter becomes 60 inches and the major axis 25 inches?

200. Proposed by R. D. CARMICHAEL, Hartselle, Alabama.

Find the equation of a curve so that the area bounded by the curve, the axis of x, and any ordinate y, is equal to $y-x$, x being the *corresponding* abscissa.

201. Proposed by F. P. MATZ, Sc. D., Ph. D., Reading, Pa.

Solve $\displaystyle\int\int^{dy/dx}\frac{dw}{1+w^2}=0.$

MECHANICS.

180. Proposed by EDWIN L. RICH, Lehigh University, South Bethlehem, Pa.

If a body is projected into the air, and the resistance of the air varies as the square of the velocity; required the equation of the curve. [From De Volson Wood's *Analytical Mechanics*, problem 10, p. 179.]

181. Proposed by F. ANDEREGG, Professor of Mathematics, Oberlin College, Oberlin, Ohio.

A triangle AOB, of which the sides, OA, AB, and the angle at O are a, b, and α, revolves uniformly about O, so that OA makes the angle nt with the axis of x, and carries a circle of which AB is the diameter. Prove that a point moving in the circumference of the carried circle with twice the angular velocity of the triangle will describe an ellipse whose axes are

$$\sqrt{(a^2+b^2+2ab\cos\alpha)}\pm\sqrt{(a^2+b^2-2ab\cos\alpha)}.$$

182. Proposed by G. B. M. ZERR, A. M., Ph. D., Parsons, W. Va.

I have a tank, the lower part of which is a hemisphere 22 feet in diameter. The rest is a cylinder 22 feet in diameter, and altitude 28 feet. This tank is connected with the earth by a vertical stand-pipe 10 inches in diameter, 130 feet long, extending 2 feet into the tank. The tank is filled by a $2\frac{1}{2}$ inch pipe 65 feet long, having one right-angled elbow delivering the water into the bottom of the stand-pipe from a steam pump under 96 pounds gauge pressure. How long will it take to fill the pipe?